[0515] The electrode layers **140** and **140** extending over the insensitive regions D and D prevent the sense current from flowing into the insensitive regions D and D, thereby controlling the generation of noise.

[0516] Referring to **FIG. 24**, the protective layer **55** is not deposited on top of the multilayer film **61**, and the insulator layer **141** is directly deposited on the magnetoresistive layer **54**. The insulator layer **141** also serves as an antioxidizing protective layer. The electrode layers **140** and **140** are directly in contact with the magnetoresistive layer **54**.

[0517] This arrangement presents a smaller electrical resistance than the arrangement in which the electrode layers **140** and **140** are deposited on the protective layer **55**, improving the characteristics of the magnetoresistive-effect device.

[0518] When the magnetoresistive-effect device shown in **FIG. 24** is produced using the manufacturing method to be described later, the angle θ**24** made between the end face **140***a* of the electrode layer **140**, extending over the insensitive region of the multilayer film **61** and in contact with the insulator layer **141**, and the top surface **54***a* of the magnetoresistive layer **54**, is set to be 60 degrees or greater, or 90 degrees or greater. This arrangement allows a certain quantity of sense current to continuously flow through the electrode layer **140**, way down to the tip thereof. The magnetoresistive-effect device shown in **FIG. 24** is more effective than the magnetoresistive-effect device shown in **FIG. 14** in the prevention of the sense current from shunting into the insensitive region, thereby in the control of the generation of noise.

[0519] In the magnetoresistive-effect device shown in **FIG. 24**, the location of the insulator layer **141** on the multilayer film **61** is accurately set using the manufacturing method to be described later and the electrode layer **140** is prevented from extending beyond the insensitive region and from narrowing the area of the magnetoresistive-effect device capable of detecting the magnetic field.

[0520] Referring to **FIG. 24**, the width dimension **T71** of the electrode layer **141** extending over the insensitive region D of the multilayer film **61** is preferably within a range from 0 μm to 0.08 μm. The width dimension **T71** of the electrode layer **140** is more preferably within a range of 0.05 μm to 0.08 μm.

[0521] In the AMR device, the hard bias layers **56** and **56** are magnetized in the X direction as shown, and the magnetoresistive layer **54** is supplied with the bias magnetic field in the X direction by the hard bias layers **56** and **56**. Furthermore, the magnetoresistive layer **54** is supplied with the bias field in the Y direction by the soft magnetic layer **52**. With the magnetoresistive layer **54** supplied with the bias magnetic fields in the X direction and Y direction, a variation in magnetization thereof in response to a variation in the magnetic field becomes linear.

[0522] The sense current from the electrode layers **140** and **140** is directly fed to the magnetoresistive layer **54** in the sensitive region E. The direction of the advance of the recording medium is aligned with the Z direction. When a leakage magnetic field from the recording medium in the Y direction is applied, the magnetization direction of the magnetoresistive layer **54** varies, causing a variation in the resistance. The resistance variation is then detected as a voltage variation.

[0523] By producing the magnetoresistive-effect device of **FIG. 24** through the manufacturing method to be described later, the side face of the multilayer film **61** and the side face of the insulator layer **141** are set to be parallel to each other.

[0524] The formation of the insulator layer between the electrode layers makes mild the inclination of the top surface of each of the magnetoresistive-effect devices as shown in **FIG. 20** through **FIG. 24**. Even if the angle made between the top surface of the protective layer, the free magnetic layer or the antiferromagnetic layer and the end face of each electrode layer becomes large, a short is less likely to occur between the electrode layers and a top shield layer of a soft magnetic material when the top shield layer is deposited over the multilayer film and the electrode layers.

[0525] The manufacturing method for manufacturing the magnetoresistive-effect devices shown in **FIGS. 20 through 24** is now discussed, referring to drawings.

[0526] Referring to **FIG. 25, a** multilayer film **151** of the magnetoresistive-effect device is formed on a substrate **150**. An insulator layer **152**, made of Al_2O_3, is formed on the multilayer film **151**. The multilayer film **151** can be any of the multilayer films of the single spin-valve type thin-film devices shown in **FIG. 20** through **FIG. 22**, the multilayer film of the dual spin-valve type thin-film devices shown in **FIG. 23**, and the multilayer film of the AMR device shown in **FIG. 24**.

[0527] To form the antiferromagnetic layer **70**, **80**, or **100** in the extended form thereof in the X direction respectively shown in **FIG. 20**, **FIG. 21**, or **FIG. 23**, an etch rate and etch time are controlled to leave the side portions of the antiferromagnetic layer **70**, **80**, or **100** when the side portions of the multilayer film **151** and the insulator layer **152**, shown in **FIG. 26**, are etched away.

[0528] When the multilayer film **151** is a multilayer film for a single spin-valve type thin-film device or a dual spin-valve type thin-film device, the antiferromagnetic layer in the multilayer film **151** is preferably made of a PtMn alloy, or may be made of an X—Mn alloy where X is a material selected from the group consisting of Pd, Ir, Rh, Ru, and alloys thereof, or a Pt—Mn—X' alloy where X' is a material selected from the group consisting of Pd, Ir, Rh, Ru, Au, Ag, and alloys thereof. When the antiferromagnetic layer is made of one of the above-cited materials, the antiferromagnetic layer needs to be subjected to a heat treatment to generate an exchange coupling magnetic field in the interface with the pinned magnetic layer.

[0529] **FIG. 33** shows a conventional magnetoresistive-effect device having its hard bias layers and electrode layers on only both sides of the multilayer film. The width dimension A of the top surface of the multilayer film of the conventional magnetoresistive-effect device is measured using an optical microscope as shown in **FIG. 31**. The magnetoresistive-effect device is then scanned across a micro track having a signal recorded thereon, on a recording medium in the direction of the track width, and a reproduction output is detected. A top width dimension of B giving an output equal to or greater than 50% of a maximum reproduction output is defined as the sensitive region E and a top width dimension of C giving an output smaller than 50% of the maximum reproduction output is defined as the insensitive region D.